A STOCHASTIC CONTROL METHOD FOR HYDROPOWER SCHEDULING

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ABSTRACT

Optimal scheduling of hydropower operations is a process involving a plethora of complicating factors. On any given day, reservoir operators must skillfully balance upcoming inflow forecasts against available storage, turbine power, and discharge capacities to maximize energy generation. Hydropower is most valuable during the day's "peak" generation period and, therefore, hydro-plants must generate as much energy as possible during the peak hours. Ideally, hydropower turbines should operate at best efficiency, where a given release volume generates the most energy. However, at times of high flows, it pays to abandon best efficiency operation and "run" at full gate. During off-peak hours, energy is normally produced at a required minimum level except when peak generation cannot maintain desirable reservoir levels. During such occasions, off-peak generation should be invoked as much as necessary. At times of extremely high flows, emergency flood gates may have to be considered, while during extreme droughts, power generation may have to cease.

This paper discusses a new control method for the optimal short-term scheduling of hydropower systems. The method is based on a problem formulation which allows the application of stochastic control techniques. Such techniques have successfully been employed in long-term reservoir control (see, for instance, Wasimi and Kitanidis [1983], Marino and Loaiciga [1985], Georgakakos and Marks [1987], and Georgakakos [1989a,b]), while their application to short-term scheduling problems is at an early stage (see, Trezos and Yeh [1987]). The new model will be used for the day-to-day operations scheduling of the Lloyd Shoals hydroelectric project of Georgia Power Company. Extensive simulation experiments indicate that usage of this control model will considerably enhance hydropower generation. Detailed descriptions of the new model, the simulation analysis, and the associated computer software are provided in Georgakakos [1989c,d].

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